WHAT IS CLAIMED IS:

1. A method for aligning gesture features of image, comprising the steps of:

capturing an input gesture image;

5   determining a closed curve formed by a binary contour image of the gesture image by preprocessing the gesture image;

drawing a curvature scale space (CSS) image of the gesture image based on the closed curve;

performing a convolution operation with respect to the sequence of a

10   coordinate-peak set formed by the CSS image and a predefined function $F(x)$ to designate the coordinate with maximal value of integration as a basis point for obtaining feature parameters of the gesture image; and

comparing each feature parameter of the gesture image with each feature parameter of a plurality of reference gesture shapes for determining

15   a gesture shape corresponding to the gesture image.

2. The method as claimed in claim 1, wherein in the step of performing a convolution operation to designate the coordinate , each feature parameter of the gesture image is obtained by performing the steps of:

calculating all sets of the peaks in the CSS image to form a

20   coordinate-peak set:

$$\{(u_i,\sigma_i)\}_{i=1,\cdots,N}^{\text{Original}}=\{(u_1,\sigma_1),(u_2,\sigma_2),\cdots,(u_j,\sigma_j),\cdots,(u_N,\sigma_N)\},$$

where N is the number of all of the detected peaks in the CSS image;

selecting a basis point k_o according to the two-dimensional distribution of the coordinate-peak set:

$$k_o = \arg\max_k (\sum_{i=1}^{k-1} \sigma_i \cdot F(1 + u_i - u_k) + \sum_{i=k}^{N} \sigma_i \cdot F(u_i - u_k)) ;$$

taking u_{k_o} as the basis point to align the coordinate-peak set through a circular rotation as:

$$\{(u_i, \sigma_i)\}_{i=1,\cdots,N}^{aligned} = \{(0, \sigma_{k_o}), \quad (u_{k_o+1} - u_{k_o}, \sigma_{k_o+1}), \ldots, \quad (1 + u_1 - u_{k_o}, \sigma_1), \ldots,$$

$(1 + u_{k_o-1} - u_{k_o}, \sigma_{k_o-1})\}$; and

calculating the feature parameter $F^I = \{(u_i^I, \sigma_i^I)\}_{i=1,\cdots,N}^{aligned}$, where N is the number of all of the detected peaks in the CSS image, I is the input gesture image.

3. The method as claimed in claim 2, wherein in the step of selecting a basis point, $F(x)$ is defined between the period of $[0,1)$.

4. The method as claimed in claim 3, wherein $F(x)$ is a zero-mean Gauss function.

5. The method as claimed in claim 4, wherein the zero-mean Gauss function is: $F(x) = \dfrac{e^{-[x^2/2\sigma^2]}}{\sqrt{2\pi}\sigma}$, $0 \le x < 1$, where σ is defined for controlling the changing rate of $F(x)$ in the period of $[0,1)$.

6. The method as claimed in claim 2, wherein in the step of selecting a basis point, $F(x)$ is an absolute increasing or decreasing function.

7. The method as claimed in claim 2, where in the step of comparing each feature parameter of the gesture image with each feature parameter of a plurality of reference gesture shapes, the feature parameter F^S of predetermined reference gesture shape is expressed as $F^S = \{\{(u_j^S, \sigma_j^S)\}_{j=1,\cdots,M}^{aligned}\}$, where M is the number of the peaks of the reference gesture shape, and S is

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the reference gesture shape.

8. The method as claimed in claim 7, wherein the step of comparing each feature parameter of the gesture image with each feature parameter of a plurality of reference gesture shapes comprises the steps of:

5   obtaining a sum of distance of the matched peaks and distance of the unmatched peaks between the feature parameter F^I of the gesture image and the feature parameter F^S of the reference gesture shapes by performing a distance function:

$$\text{dist}(F^I, F^S) = \sum_{\substack{\text{matched} \\ \text{peaks}}} \sqrt{(u_i^I - u_j^S)^2 + (\sigma_i^I - \sigma_{j,}^S)^2} + \sum_{\substack{\text{unmatched} \\ \text{peaks}}} \sigma_i^I + \sum_{\substack{\text{unmatched} \\ \text{peaks}}} \sigma_{j,}^S \; ; \text{ and}$$

10   utilizing a nearest neighbor algorithm to determine a reference gesture shape of the gesture image.

9. The method as claimed in claim 8, wherein in the step of utilizing a nearest neighbor algorithm to determine a reference gesture shape of the gesture image, the nearest neighbor algorithm is utilized to recognize
15   gesture for finding the nearest reference gesture shape with respect to the gesture image so as to determine a gesture shape corresponding to the gesture image.

10. The method as claimed in claim 1, wherein in the step of drawing a curvature scale space (CSS) image, the CSS image is obtained by
20   performing the steps of:

$$\text{determining a curvature } \kappa(u) = \frac{\dot{x}(u)\ddot{y}(u) - \ddot{x}(u)\dot{y}(u)}{(\dot{x}^2(u) + \dot{y}^2(u))^{3/2}} \text{ of a closed curve}$$

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$\Gamma = \{x(u), y(u)\}$, where u is a normalized arc length parameter, $\dot{x}(u) = \dfrac{dx}{du}$,

$\ddot{x}(u) = \dfrac{d^2x}{du^2}$, $\dot{y}(u) = \dfrac{dy}{du}$, and $\ddot{y}(u) = \dfrac{d^2y}{du^2}$;

performing an operation with respect to the closed curve and a Gauss function to determine a smooth curvature function $\Gamma_\sigma = \{\, X(u,\sigma), Y(u,\sigma)\,\}$

5   and its curvature $\kappa(u,\sigma) = \dfrac{X_u(u,\sigma)Y_{uu}(u,\sigma) - X_{uu}(u,\sigma)Y_u(u,\sigma)}{(X_u(u,\sigma)^2 + Y_u(u,\sigma)^2)^{3/2}}$, where

σ is standard deviation,

$$X(u,\sigma) = x(u)*g(u,\sigma) = \int_{-\infty}^{\infty} x(v)\cdot\dfrac{1}{\sigma\sqrt{2\pi}}\cdot\exp(\dfrac{-(u-v)^2}{2\sigma^2})dv ,$$

$$Y(u,\sigma) = y(u)*g(u,\sigma) = \int_{-\infty}^{\infty} y(v)\cdot\dfrac{1}{\sigma\sqrt{2\pi}}\cdot\exp(\dfrac{-(u-v)^2}{2\sigma^2})dv ,$$

$X_u(u,\sigma) = x(u)*\dot{g}(u,\sigma)$, $X_{uu}(u,\sigma) = x(u)*\ddot{g}(u,\sigma)$,

10    $Y_u(u,\sigma) = y(u)*\dot{g}(u,\sigma)$, $Y_{uu}(u,\sigma) = y(u)*\ddot{g}(u,\sigma)$,

$\dot{g}(u,\sigma) = \dfrac{\partial}{\partial u}g(u,\sigma)$, and $\ddot{g}(u,\sigma) = \dfrac{\partial^2}{\partial u^2}g(u,\sigma)$; and

utilizing different standard deviations σ to find a location having zero curvature in Γ_σ, and continuously drawing all locations having zero curvature under different standard deviations.

15   11. The method as claimed in claim 10, wherein the normalized arc length parameter u has a value between 0 and 1.

12. The method as claimed in claim 10, wherein in the step of

performing an operation with respect to the closed curve and a Gauss function, the operation performed with respect to the close curve and the Gauss function is a convolution operation.

13. The method as claimed in claim 10, wherein in the step of performing an operation with respect to the closed curve and a Gauss function, the Gauss function is:

$$g(u,\sigma) = \frac{1}{\sigma\sqrt{2\pi}} \exp(\frac{-u^2}{2\sigma^2}).$$

14. The method as claimed in claim 10, wherein in the step of utilizing different standard deviations to find a location having zero curvature, in the $u-\sigma$ coordinate, a position of $\kappa(u,\sigma) = 0$ is defined as the zero curvature point.